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Report No. 9

SENSITIVITY OF CASED EXPLOSIVE MATERIALS TO IMPACT BY REGULAR FRAGMENTS (U)

Contract No. DA-19-020-ORD-5617

PA Control No. PA-AG-62-1

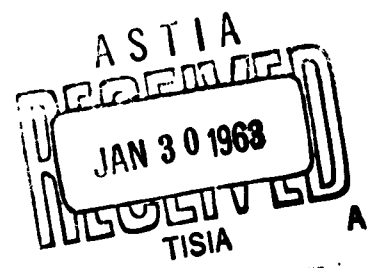
Prepared by

Arthur D. Little, Inc.
Cambridge, Mass.

For

Commanding Officer
Picatinny Arsenal
Dover, New Jersey

30 November 1962



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A R T H U R D . L I T T L E , I N C .

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ABSTRACT

This is the ninth in a series of monthly reports on an experimental program dealing with the sensitivity of certain cased explosives and propellants to impact by regular fragments. The program is designed to aid in determining a more realistic quantity-distance relationship for the storage of Ordnance explosive material. It is the intent of this project, through an experimental program, to establish a limiting fragment mass vs impact velocity relationship for the detonation of certain explosives and/or propellants enclosed in casings of different thicknesses.

This report discusses the first firings of fragments into receiver charges cast with pentolite explosive - no detonations were recorded.

SENSITIVITY OF CASED EXPLOSIVE MATERIALS TO

IMPACT BY REGULAR FRAGMENTS (U)

INTRODUCTION

This is the ninth report on an experimental program covering the progress of Contract DA-19-020-ORD-5617 for Picatinny Arsenal. This report covers the period 31 October 1962 to 30 November 1962. The objective of the program is to determine the sensitivity of certain cased explosives and propellants to impact by regular fragments. A technique of explosive fragment acceleration is being used to cover the range of velocities of interest. This method is feasible, economical and almost mandatory for high fragment velocities. Receiver charges containing pentolite were delivered by Picatinny Arsenal on November 16, 1962. Twelve firings into these charges were conducted during the report period. There were no receiver charge detonations. Attempts to obtain high speed camera coverage of an explosively launched fragment were not successful. This effort will be repeated early in December.

CONTRACT STATUS

The present contract was due to expire on November 28, 1962. However, an extension to May 27, 1963 has been received.

TEST FIRING

All test firings conducted during the report period are listed in Table 1. 0.2, 0.5 and 2.6 oz fragments were fired into cased pentolite receiver charges. Firings No. 96, 99 and 105 were made with the receiver charge mounted horizontally without backup (The charge was free to move in two horizontal directions). There was no significant difference in the results obtained. All other firings were vertical (the same as those previously reported). No burning and/or detonations took place. It is possible, however, that some minor reaction did occur with firing no. 103. The receiver charge casing was completely broken up and

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scattered over a large area. There was some fine powder on the ground near the impact point. There was no evidence of burning on the recovered pieces of the casing and no marks on the witness plate to indicate even a low order detonation.

VISIT TO TEST SITE

On November 16, 1962, representatives of Picatinny Arsenal visited the Winchester, New Hampshire test facility of Arthur D. Little, Inc. and witnessed firings no. 95 through 100 inclusive. Six additional firings (101-106) were made on November 19 and 20, 1962. All firings into receiver charges have been held up pending a review of previously established mass-velocity relationships as well as test techniques being used in this program.

FUTURE WORK

Major effort will be devoted to obtaining high speed motion picture coverage of the explosively launched fragment in flight. A complete evaluation of test procedures and data recording techniques is also to be made. No test firings at receiver charges are anticipated during the next report period.

MAN HOURS EXPENDED

Total inclusive man hours to date on this program are 1806 or 63% of the initial estimated man hours. Of this, 197 or 7% were expended during this report period.

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TABLE I
FRAGMENT IMPACT FIRINGS

| <u>Firing No.</u> | <u>Date</u> | <u>Fragment Size</u> <u>Dim(in)</u> | <u>Wt.(oz)</u> | <u>Velocity</u> <u>ft/sec</u> | <u>Remarks</u> |
|-------------------|-------------|--|----------------|----------------------------------|--|
| 89 | 11/9/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | No receiver charges used. These firings were made in an attempt to obtain high speed pictures of fragment in flight. No success. |
| 90 | 11/9/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | |
| 91 | 11/9/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | |
| 92 | 11/14/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | No receiver charges used. These firings were made in an attempt to obtain high speed pictures of fragment in flight- Camera was found to be operating poorly - No results. |
| 93 | 11/14/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | |
| 94 | 11/14/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | |
| 95 | 11/16/62 | 7/8 x 7/8 x 3/4 | 2.6 | 2865 | No detonation. Fragment went through flange on receiver charge. |
| 96 | 11/16/62 | 7/8 x 7/8 x 3/4 | 2.6 | 4840 | Firing made horizontally. Receiver charge was not backed up. No witness plate used. Fragment hit inside edge of thick wall. Explosive mat'l thrown out completely. No detonation. No burning. |
| 97 | 11/16/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | Vertical firing. Good hit. Fragment penetrated casing buried in charge. Some possible scorching. No burning No detonation. |

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TABLE I (Cont.)

FRAGMENT IMPACT FIRINGS

| <u>Firing No.</u> | <u>Date</u> | <u>Fragment Size</u> <u>Dim(in)</u> | <u>Wt(oz)</u> | <u>Velocity</u> <u>ft/sec</u> | <u>Remarks</u> |
|-------------------|-------------|--|---------------|----------------------------------|--|
| 98 | 11/16/62 | 1/2 x 1/2 x 1/2 | 0.54 | 3300 | Vertical firing. Good hit. Tore top plate off charge. Kneaded out 1/2 of the explosive mat'l. No burning. No detonation. |
| 99 | 11/16/62 | 1/2 x 1/2 x 1/2 | 0.54 | 1910 | Horizontal firing - receiver charge not backed up - no witness plate. Explosive mat'l completely out of casing and pulverized. No detonation No burning. |
| 100 | 11/16/62 | 7/8 x 7/8 x 3/4 | 2.6 | 5280 | Vertical firing. Fragment hit flange on charge. Tore casing completely open. Most of explosive mat'l thrown out. No detonation. No burning. |
| 101 | 11/19/62 | 3/8 x 3/8 x 5/16 | 0.2 | 4640 | Vertical firing. Good hit. Cover plate ruptured and pushed out. 1/2 explosive mat'l pushed out of casing and left on witness plate. |
| 102 | 11/19/62 | 3/8 x 3/8 x 5/16 | 0.2 | 4520 | Vertical firing. (during set-up explosive slipped out of receiver charge. Loose in casing. Was pushed back in and used). Good hit. Bulged plate upward - 1/2 explosive mat'l pushed out of casing and pulverized. No detonation. No burning. |
| 103 | 11/19/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | No cover plate - vertical firing - casing broken up. Scattered nearby within 50-foot radius. Fine explosive mat'l scattered around. No marks on witness plate. No evidence of burning on any pcs. Possible very low order detonation. |

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TABLE I (Cont)

FRAGMENT IMPACT FIRINGS

| <u>Firing No.</u> | <u>Date</u> | <u>Dim(in)</u> | <u>Fragment Size</u> <u>Wt(oz)</u> | <u>Velocity</u> <u>ft/sec</u> | <u>Remarks</u> |
|-------------------|-------------|------------------|---------------------------------------|----------------------------------|--|
| 104 | 11/19/62 | 3/8 x 3/8 x 5/16 | 0.2 | 4441 | No cover plate - vertical firing - 1/4 of charge broken up and thrown out. No burning. No detonation. |
| 105 | 11/19/62 | 3/8 x 3/8 x 5/16 | 0.2 | ----- | Horizontal firing. Thru 1/16" plate. Good hit. 3/4 explosive mat'l thrown out - some powder laying around on ground. No evidence of detonation. No physical evidence of burning. Slight odor of burning around area when approached. |
| 106 | 11/20/62 | 3/8 x 3/8 x 5/16 | 0.2 | 5100 | Repeat of 103-104. Good hit - 1/4 of explosive mat'l thrown out and scattered. No detonation. No burning. |

REPORT DISTRIBUTION

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